He remarks that the displacement of the bright lines of the spectrum of the chromosphere cannot be explained in the manner attempted by Father Secchi, by the rotation of the Sun, whatever the velocity of rotation is assumed to be. "For I have frequently seen a change of wave length in the same direction in the spectrum of prominences on opposite sides of the Sun, and if the change was produced by the Sun's rotation the change must be in opposite directions, since one side is approaching and the other receding from us. I also frequently see a change of wave length in the spectrum of one part of a prominence and not in another. How does Father Secchi's theory account for this? Besides, on his hypothesis, the bright lines of the prominences should never appear curved as I often see them, but should remain perfectly straight. The black lines should, on his hypothesis, be also displaced like the bright ones, so that the bright lines would still retain their position with respect to their corresponding black line, whatever be the velocity. Perhaps every one in eight of the prominences I have seen,—and I see two or three every time I looked at the Sun,—have given decided changes of wave length; in fact, the occurrence is so frequent, that unless any extraordinary change is seen, I make no note of it, and the changes of wave length are continually varying, and seldom last more than a quarter to half an hour, which clearly shows that the Sun's rotation has nothing to do with. That there are tremendous movements in the chromosphere is certain, from (1) the alteration of wave length observed in the space of a few minutes or sometimes seconds; (2) when a prominence is observed with a wide slit a change of form can generally be detected in a few minutes;" and he annexes rough sketches of the F line of two prominences showing change of wave length.

London,
June 1, 1860.

On a Spectroscope in which the Prisms are automatically adjusted to the minimum angle of deviation for the particular Ray under examination. By J. Browning, Esq.

In an ordinary spectroscope the prisms are usually adjusted to the minimum angle of deviation for the most luminous rays in the spectrum,—by preference I adjust them myself for the ray E in the solar spectrum. This being done, the prisms are screwed, or otherwise firmly clamped, to the main plate of the spectroscope. Thus adjusted they are liable to two sources of error, one of which places the observer at a serious disadvantage. First, only the particular ray for which the prisms have been adjusted, is seen under the most favourable circumstances, for only this ray passes, as all should do, through the train of prisms parallel to the base of each prism. Of more importance than this, however, is the

fact that the last prism of the train being fixed while the telescope through which the spectrum is viewed is moveable around an arc, it is only when the central portion of the spectrum is being examined, that the whole field of the object-glass is filled. By means of the models, as well as the instrument, which is before you, I hope to make myself clear on this point.

In figure 1, P P &c., represent a train of prisms adjusted as I have just described for the central portion of the spectrum, and screwed firmly in their places. T represents a telescope moving round a centre situated at K. In the position in which

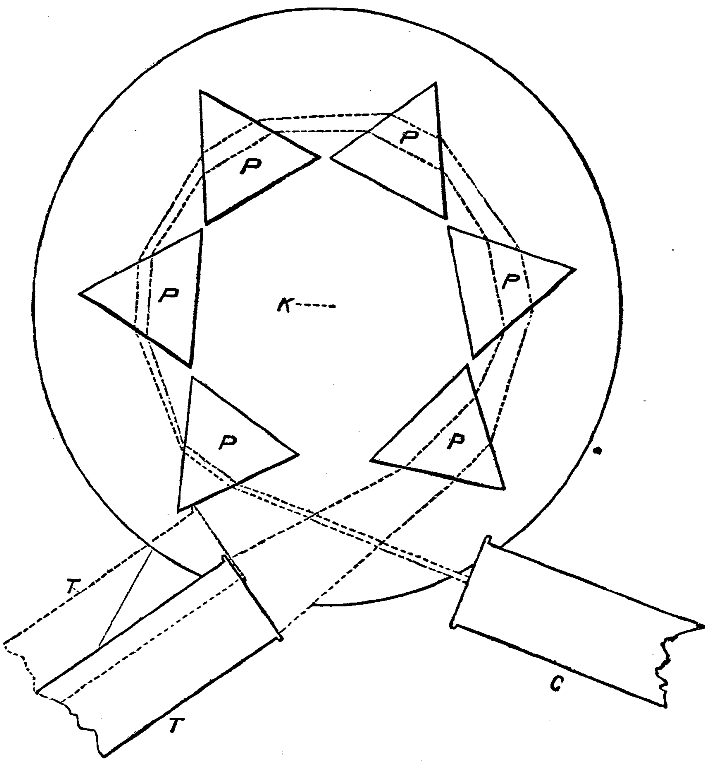


Fig. 1.

the telescope is placed, the whole field of the object-glass would be filled with the green light of the spectrum issuing from the last prism; but when the telescope is removed to the position shown by the dotted lines, either nearer to R or to V (in which case the red end or the violet end of the spectrum would be in the field of view), then, as you will see by the lines, only a small portion of the spectrum would fall on the object-glass. But it is obvious that owing to the deficiency in light at the extreme ends of the spectrum, it is just in these very positions that it is desirable that the whole field of the object-glass should be filled. Now this can only be effected when the prisms are adjusted to the minimum angle of deviation for the particular portion which is being examined of the spectrum; and this it will be if the adjustment I have spoken of has been correctly made. This

difference in adjustment is much more than is generally supposed, varying, in accordance with the refractive index of the glass employed, between 10° and 20° for the extreme portions of the spectrum.

Bunsen and Kirchoff, when making their celebrated map of the solar spectrum, adjusted the prisms they used (four in number) for the principal Fraunhofer lines; but the trouble of doing this is so great that few observers have ever seen the extreme portions of the solar spectrum under favourable circumstances.

A distinguished professor of natural philosophy informs me that he once adjusted a train of prisms for the line H in the solar spectrum, but that he found the experiment so troublesome that he should not be likely to repeat it unless for purposes of accurate investigation it were indispensable.

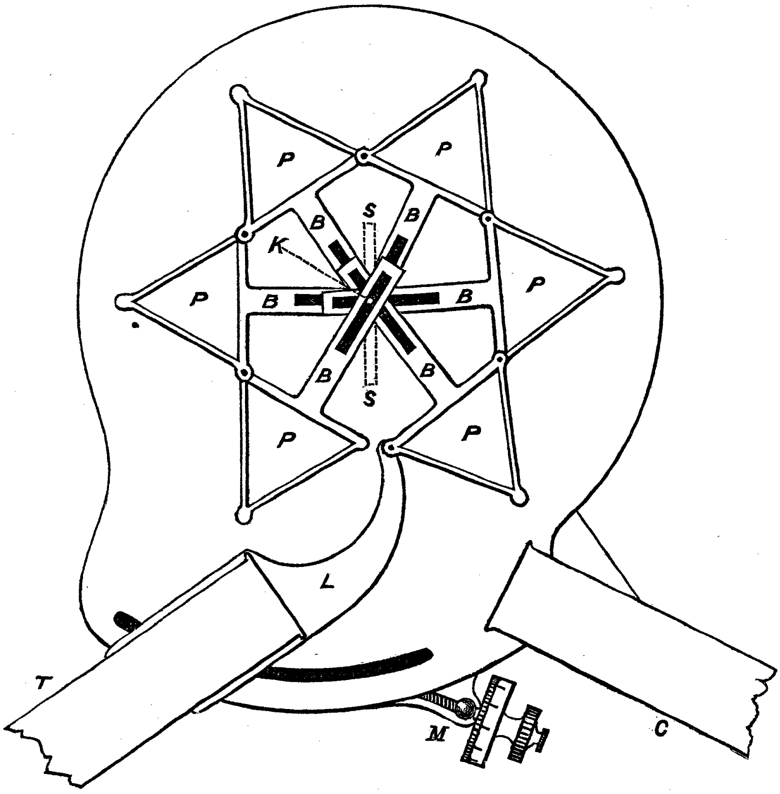


Fig. 2.

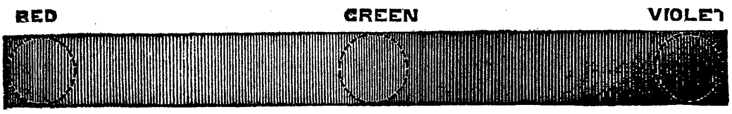
Diagram 2 shows the method in which the change in the adjustment of the prisms to the minimum angle of deviation for each particular ray is made automatically. In this diagram, P P &c., as before, represent prisms. All these prisms, with the exception of the first, are unattached to the plate on which they stand. The triangular stands on which the prisms rest are hinged together at the angles corresponding to those at the bases of the prisms. To each of these bases is attached a bar, B, perpendicular to the base of the prism. As all these bars are slotted and run on a common centre, the prisms are brought into

a circle. This central pivot is attached to a dovetailed piece of two or three inches in length, placed on the under side of the main plate of the spectroscope, which is slotted to allow it to pass through. On moving the central pivot the whole of the prisms are moved, each to a different amount in proportion to its distance in the train from the first or fixed prism, on which the light from the slit falls after passing through the collimator, C. Thus, supposing the first prism of the train of C, represented in the diagram, to be stationary, and the second prism to have been moved through 1° by this arrangement; then the third prism will have been moved through 2°, the fourth through 3°, the fifth through 4°, and the sixth through 5°.

Now for the contrivance by which this arrangement is made automatic. A lever, L, is attached by a hinge to the corner of the triangular plate of the last prism. This lever, by its further end, is attached to the support which carries the telescope, through which the spectrum is observed. Both the telescope and lever are driven by the micrometer-screw, M. The action of the lever is so adjusted that, when the telescope is moved through any angle it causes the last prism to turn through double that angle. The rays which issue from the centre of the last prism are thus made to fall perpendicularly upon the centre of the object-glass of the telescope, T, and thus the ray of light travels parallel to the bases of the several prisms, and ultimately along the optical axis of the telescope itself, and thereby the whole field of the object-glass is filled with light.

Thus the apparatus is so arranged that on turning the micrometer-screw, so as to make a line in the spectrum coincide with the cross-wires in the eye-piece of the telescope, the lever L, attached to the telescope and prisms, sets the whole of the prisms in motion, and adjusts them to the minimum angle of deviation for that portion of the spectrum.

Fig. 3.



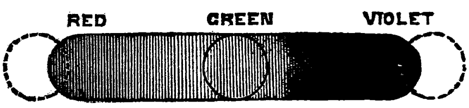


Fig. 4.

Diagrams 3 and 4 represent the appearances presented when looking through the telescope from which the glasses have been removed. In diagram 3 it will be seen that the whole circle of the object-glass is filled with light, as I have just described, is the case with the new arrangement; while diagram 4 shows the

effect of moving the telescope through the angle in front of the fixed prism.

About three years ago I showed a rough model of the plan I have now described, to Mr. Gassiot, for whom I made the large instrument which was some time in use at the Kew Observatory. Mr. Gassiot immediately asked me if I would apply this arrangement to his large spectroscope. As I did not at that time see my way to make it self-acting by connecting the prisms with the micrometer-screw, I did not feel impelled to carry out the matter at once, owing to the fact that about this time the mapping of the solar spectrum with the large spectroscope in question was discontinued. I also felt that, with that munificent liberality for which Mr. Gassiot has distinguished himself, he had simply asked me to add this contrivance to his large and costly instrument in the interest of science generally, and not with any view to its immediate use.* Since this time, and particularly while I was constructing his solar spectroscope, Mr. Norman Lockyer has repeatedly urged upon me the desirability of completing the arrangement; and from the manner in which it has been received by the distinguished scientific men who have done me the honour to examine it minutely, I am induced to hope that its application will tend to facilitate further researches in spectrum analysis.

Note on the Alteration in the Colour of the Belts of Jupiter.

By John Browning, Esq.

In the Report of the Astronomer Royal to the Board of Visitors, there is the following remark:—

"There has been little opportunity of employing the instrument on other objects, except in a drawing of *Jupiter* by Mr. Carpenter.

"The comparison of this with drawings made eight or nine years ago appears to negative the idea of any change in the colour of *Jupiter's* belts."

With all possible deference to the Astronomer Royal and Mr. Carpenter, I beg to submit that a comparison of drawings made either this year or last year with others made eight or nine years ago, might not throw any light on this question. There is, as I have pointed out in my previous papers on this subject, some reason to believe that the change in colour in the equatorial belt of *Jupiter* is periodical. This belt of the planet at the time mentioned may have been of the same colour as during the last presentation,—that it was differently coloured during the presentation of 1868–9, is a fact attested by some six or seven, at least, well-known and skilful observers. It is true

* I am indebted to M. Gassiot for the opportunity of exhibiting the instrument on this occasion.